
M015: SNOW AND ICE MOVEMENT

TSP Number/Title	M015
TSP User	The following courses use this TSP: Mountain Instructor Qualification Course (MIQC) Basic Military Mountaineering Course (BMC) Assault Climber Course (ACC)
Effective Date	Implement next class iteration upon receipt
Supersedes TSP(s)/Lessons	None
TSP User	The following courses use this TSP: Mountain Instructor Qualification Course (MIQC) Basic Mountaineering Course (BMC) Assault Climber Course (ACC)
Proponent	United States Army Alaska, Northern Warfare Training Center
Improvement Comments	Send comments and recommendations on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: ATTN: TRAINING ADMINISTRATOR COMMANDANT USARAK NWTC 1060 GAFFNEY ROAD #9900 FORT WAINWRIGHT AK 99703-9900
Security Clearance/Access	Public domain
Foreign Disclosure Restrictions	The Lesson Developer in coordination with the USARAK NWTC foreign disclosure authority has reviewed this lesson. This lesson is releasable to foreign military students from all requesting foreign countries with Approval of Commandant USARAK NWTC.

PREFACE

Purpose

This training support package provides the instructor with a standardized lesson plan for presenting instruction for:

Task Number	Task Title
VIII.1000	Individual Movement on Snow and Ice

Technique of Delivery

Lesson Number	Instructional Strategy	Media
M015	Class and Practical Exercise	None

This TSP contains

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SECTION I ADMINISTRATIVE DATA**All courses including this lesson**

Course Number	Course Title
NA	Mountain Instructor Qualification Course
NA	Basic Mountaineering Course
NA	Assault Climber Course

Task(s) Taught or Supported

Task Number	Task Title
VIII.1000.A	Demonstrate proper fitting and wear of crampons
VIII.1000.B	Demonstrate proper crampon and ice axe technique on level snow covered terrain
VIII.1000.C	Demonstrate proper crampon and ice axe technique on angled snow and ice
VIII.1000.D	Demonstrate self belay and self arrest technique
VIII.1000.E	Demonstrate glissading
VIII.1000.F	Demonstrate step cutting on snow and ice

Task(s) Reinforced

Task Number	Task Title
I.0200	Mountain Environment
VI.0200	Risk Management for Mountain Operations
VIII.0100	Mountain Travel and Walking Techniques
VIII.0200	Mountaineering Equipment

Test Lesson Number

Hours	Lesson Number	Lesson Title
	M020	BMC Mountaineering Review

Prerequisite Lesson(s)

-M001, Mountain Environment, I.0200.05, Identify Mountain Hazards in Snow Free Terrain, I.0200.06, Identify Mountain Hazards in Snow Covered Terrain
-M005, Risk Management for Mountain Operations
-M006, Mountain Travel and Walking Techniques, VII.0100.03, Describe and demonstrate use of the ice axe in snow free mountainous terrain, VII.0100.04, Demonstrate march discipline in mountainous terrain, VII.0100.05, Demonstrate fundamentals of mountain walking technique
-M007, Mountaineering Equipment, VIII.0200.14, Describe the characteristics/maintenance of ice axes, VIII.0200.15, Describe the characteristics/maintenance of crampons

References

Number	Title	Date	Additional Information
	NWTC Cold Weather Operations Manual	FY04	Updated yearly
	NWTC Mountain Operations Manual	FY04	Updated yearly
FM 3-97.6	Mountain Operations	November 2000	http://www.adtdl.army.mil/
FM 3-97.61	Military Mountaineering	August 2002	http://www.adtdl.army.mil/

Student Study Assignment

Read TSP M015

Instructor Requirements

One Small Group Leader TAITC, and Summer IQC qualified.

Additional Support Personnel Requirements	None
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Equipment Required	<p>Instructor Equipment:</p> <ul style="list-style-type: none">• Ice axe• Crampons• Helmet <p>Student Equipment:</p> <ul style="list-style-type: none">• Ice axe• Crampons• Pen and notepad• Helmet
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**Materials
Required**

Instructor Materials:

- NWTC Mountain Operations Manual
- Risk Management for Mountain Operations

Student Materials:

- NWTC Mountain Operations Manual
 - Risk Management Guide for Mountain Operations
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**Classroom,
Training Area
and Range
Requirements**

Classroom and training area must be large enough to accompany students and the SGL.

**Ammunition
Requirements**

None

**Instructional
Guidance**

Before presenting this lesson, instructors must thoroughly prepare by studying this lesson and identified reference material.

**Branch Safety
Manager
Approval**

NAME	Rank	Position	Date
Mark Gilbertson	GS-09	Training Specialist	

**Proponent
Lesson Plan
Approvals**

NAME	Rank	Position	Date
Peter Smith	GS-12	Training Administrator	

M015: SNOW AND ICE MOVEMENT

SECTION II

INTRODUCTION

Method of instruction: Small Group
Type of instruction: Class
Instructor to student ratio: 1:8
Time of instruction: 2 Hours
Media used: None

Motivator

Mountain ranges often have a perennial snow cover; those that do not, including low mountain ranges may get snow at any time of the year. Snow and ice add another hazard for soldiers to consider. Ski and snowshoes often provide the means to oversnow/ice travel. However, when the slopes steepen or conditions are too icy for these tools, soldiers must use other means to travel in the mountains.

Terminal Learning Objective

ACTION:	Demonstrate the ability to move in a snow and/or ice covered environment
CONDITION:	In a snow and/or ice covered environment, given an ice axe, crampons
STANDARD:	Demonstrate the ability to move in a snow and/or ice covered environment IAW the NWTC Mountain Operations Manual.

Safety Requirements

Ensure that students:

- Receive a risk assessment prior to movement to the training area and before practical exercises.
- Have all necessary equipment for the PE's, to include any additional equipment required by the NWTC SOP.
- Have two full canteens and drink adequate water to avoid becoming dehydrated.
- Receive a briefing on the symptoms of heat injury or cold weather injury, as appropriate.

Risk Assessment Level

Determined by instructor

Environmental Considerations

None

Evaluation

You will be evaluated on this task during the Alpine FTX and questions related to this subject may appear on the written test.

Instructional Lead-in

You have learned about the mountain environment, proper walking technique, and mountaineering equipment. With these skills you will now learn how to wear and use your crampons, use the ice axe, and how to do some step cutting on snow and ice.

SECTION III**PRESENTATION****ELO A**

ACTION:	Demonstrate proper fitting and wear of crampons
CONDITION:	In a snow and/or ice covered environment, given an ice axe, crampons
STANDARD:	Demonstrate proper fitting and wear of crampons IAW the NWTC Mountain Operations Manual.

Learning Step Activity 1 – Fitting and Wear of Crampons

a. Crampons are devices worn over boots to provide firm footing on ice or hard snow. They consist of light metal frames normally with 10-12 points protruding from the bottom and front. Crampon mounting systems are varied, but all use a strap system, a clamping system or a combination of both. The strap mounts are most useful, as the boot type or size is of little consequence to the fit. The clamping system consists of steel bails that fit horizontally into specific grooves in the toe and heel of the mountain boots. These type crampons will have the tightest fit and provide the best precision for vertical ice climbing. With this precise fit comes a few limitations: all clamp type crampons do not fit all boots without modification to the bails and this type crampon will not remain on any boot other than boots manufactured specifically to use this type of crampon.

b. The flexible crampon in use for NWTC courses uses a strap system. There is also a single adjustment point between the front and rear section that allows the crampon to be adjusted to the boot in use. Make this adjustment and then use the straps to ensure that the crampon remains in place while walking or climbing.

c. Some tips for using these crampons BEFORE you move out to the field:

1. Find a grassy area and practice putting the crampons onto the boots. Then walk with the crampons on to determine if they are fit properly. A properly fit crampon will not come off the foot.
2. Locate buckles to the outside to prevent snagging on boots/clothing. Trousers should be bloused to prevent catching on crampons. Gaiters will also help to prevent you from catching a crampon point on the inside of the trousers.

ELO B

ACTION:	Demonstrate proper crampon and ice axe technique on level snow covered terrain
CONDITION:	In a snow and/or ice covered environment, given an ice axe, crampons
STANDARD:	Demonstrate proper crampon and ice axe technique on level snow covered terrain IAW the NWTC Mountain Operations Manual.

Learning Step/Activity 1 – Walking in Crampons

a. Walking in crampons is not complicated but it does present difficulties. When walking in crampons, the same principles are used as in mountain walking, except that when a leg is advanced it is swung in a slight arc around the fixed foot to avoid locking the crampons or catching them in clothing or flesh. The trousers should be bloused to prevent catching on crampons. Secure all straps to prevent stepping on them and snagging, potentially causing a fall. The buckles should be located on the outside of each foot when the crampons are secured to prevent snagging. Remember, when the crampon snags on the pants or boots, a tear or cut usually results, and sometimes involves the skin on your leg and/or a serious fall.

Learning Step/Activity 2 – Walking with the Ice Axe

a. When walking on snow or ice, the ice axe can be used as a third point of contact or carried until needed.

1. Cane Position: The ice axe is held by the head with the spike down. The wrist loop on the leash should be placed around one wrist. The pick faces to the rear. It is used on gentle slopes as a walking stick or cane. When moving up or down gentle slopes the ice axe is placed in front as the third point of

contact When traversing, the axe is held on the uphill side.



CANE POSITION

2. Carry position: The ice axe is held at the balance point on the shaft with the pick to the rear, facing down. The wrist loop on the leash is worn around the wrist.

ELO C

ACTION:	Demonstrate proper crampon and ice axe technique on angled snow and ice
CONDITION:	In a snow and/or ice covered environment, given an ice axe, crampons
STANDARD:	Demonstrate proper crampon and ice axe technique on angled snow and ice IAW the NWTC Mountain Operations Manual.

Learning Step Activity 1 – Movement on moderate to steep ice/snow covered terrain

a. Methods of ascent (crampon use):

1. **Traverse:** A traverse on ice or snow looks much like any mountain walking traverse, except that the ankles are rolled so that the crampons are placed flat on the surface. On snow the points penetrate easily; on ice the foot must be pressed or stamped firmly to obtain maximum penetration. At the turning points of a traverse, direction is changed with the uphill foot as in mountain walking.

2. **Straight-Up:** A straight up method is for relatively short pitches, since it is more tiring than a traverse. The climber faces directly up the slope and walks straight uphill. As the slope steepens, the herringbone step is used to maintain the flatfoot technique.

3. A **combination** of these techniques may also be employed. The feet will cross over one another as the climber ascends diagonally up the slope. To begin, start in a good position of balance (as in the photo below, left). The ice axe should be held in the cane position on the uphill side. Move up the slope in a two-step sequence. Begin with the downhill foot and bring it in front of and over the uphill foot. Then return to a position of balance by moving the lower foot up from behind and placing it flat on the surface. Move the ice axe up slope and repeat the process. This is a fast and efficient way to move up slope. Because you are crossing your feet over, there is a chance that you can hook a crampon on a pant leg; each step must be deliberate to avoid this possibility.

4. For short steep pitches, the climber may also face down slope, squatting so the legs form almost a 90 degrees angle at the knees, driving the spike of the ice axe into the slope at hip level, and then moving the feet up to the axe. By repeating these steps, the axe and crampon combination can be used to climb steep, short pitches without resorting to step cutting. This method can be very tiring. The technique is similar to the crab position used for climbing on slab rock and can also be used for short descents.



Flat foot technique: Correct Use



Incorrect Use

e. **Front-pointing** (also known as German technique), may be used for moving straight uphill. It is especially useful on very steep terrain, in combination with the ice axe in the push-hold, dagger, or hammer position. Front pointing is easiest with the use of more rigid mountain boots and rigid crampons, as the technique is very similar to doing calf raises on the tips of the toes and is much more tiring than flat footing. The technique starts with the feet approximately shoulder width apart. When a step is taken the climber will place the front points of the crampons into the ice with the toe of the boot pointing straight into the slope. When the front points have bitten into the ice the heel of the boot is lowered slightly so that the first set of vertical points can also bite. The body is kept erect, with the weight centered over the feet as in climbing on rock.



Front Pointing

b. Methods of ascent (ice axe use):

1. **Cross Body Position or Port Arms Position:** On steeper slopes the axe can be used in the port arms position, or cross body position. It is carried across the chest, up slope hand on the shaft, spike into the slope. The head is held away from the slope, pick to the rear in preparation for self-arrest. Ensure the leash is connected to the up slope hand, this allows the axe to be used in the hammer position on the up slope side of the climber. The spike, in this case, is used as an aid for maintaining balance.



Cross Body Position

2. **Anchor Position:** As the slope continues to steepen, the axe may be used in the anchor position. The head is held in the uphill hand and the pick is driven into the slope. The spike is held in the downhill hand and pulled slightly away from the slope to increase the "bite" of the pick into the ice.



Anchor Position

3. **Push-Hold Position:** Another variation on steep slopes is the push-hold position. The hand is placed on the shaft just below the head with the pick forward. The pick is driven into the slope at shoulder height. The hand is then placed on the top of the axe head for use as a handhold.



Push Hold Position

4. **Dagger Position:** This position is used on steep slopes to place a handhold above shoulder height. The hand grasps the head of the axe with the pick forward, shaft hanging down. It is driven into the surface in a stabbing action. The hand is then placed on the axe head for use as a handhold.



Dagger Position

5. **Hammer Position:** This position will set the pick deepest in any snow/ice condition. The axe is used like a hammer with the pick being driven into the slope. On vertical or near-vertical sections, two axes used in the hammer position will often be required.



Hammer Position

6. As you can see, there are many ways to hold and use the alpine axe and use the crampons. Some positions are more effective than others, depending on the intended result. By employing a variety of these positions, a single axe can be "climbed" in steps to move up slope on low angle to near vertical terrain. This is accomplished by positioning the feet in a secure stance and placing the axe in hammer position as high as possible. Slowly and carefully move the feet to higher positions alternately, and move the hand up the axe shaft. Repeat this until your hand is on top of the head of the axe. Remove the axe and place it higher and repeat the process.



Step 1



Step 2



Step 3



Step 4

c. **Descending with Crampons and Ice Axe:** Whenever possible, descend straight down the fall line. As the slope steepens, gradually turn sideways; on steeper slopes, bend at the waist and knees as if sitting, keeping the feet flat to engage all vertical crampon points and keep the weight over the feet as in descending rock slab. On very steep terrain, assume a cross body or "Port Arms" position with the axe, and traverse. The crab position or front pointing may also be used for descending. Regardless of the technique used, always ensure the points of the crampons are inserted in the snow or ice and take short, deliberate steps to minimize the chance of tripping and falling down the slope.



ICE AXE IN DESCENT



IN THE CRAB POSITION

ELO D

ACTION:	Demonstrate self belay and self arrest technique
CONDITION:	In a field environment, given a snow covered slope with a run-out, ice axe and helmet
STANDARD:	Demonstrate self belay and self arrest technique IAW the NWTC Mountain Operations Manual.

Learning Step Activity 1 – Self belay

a. A simple way to use the ice axe to prevent a fall on snow covered terrain is to plunge the shaft into the snow. If the climber take a fall, the climber should slide the hands down the shaft to where it meets the snow and use the ice axe as an anchor. This is the simplest method of self arrest.



Self Belay in Snow

Learning Step Activity 2 – Self Arrest

a. Self Arrest Technique: A climber who has fallen may roll or spin; if this happens, the climber must first gain control of his body, whether it is with his ice axe or simply by brute force. Once the roll or spin has been controlled, the climber will find himself in one of four positions:

1. Head up slope, stomach on the slope and feet pointed down slope
2. Head up slope, back to the slope and feet pointed down slope
3. Head down slope, stomach on the slope and feet pointed up slope
4. Head down slope, back to the slope and feet pointed up slope

The first position is the easiest to arrest from. This position is the one that the climber will attempt to get into to complete the self arrest process (this will be demonstrated in a moment). The climber will usually be traveling with the ice axe in the cane position. Regardless of the initial position of the ice axe, if the climber falls the axe is quickly brought across the body and the shaft is grasped towards the spike as shown in the picture below. If the climber is wearing crampons they should never be brought in contact with the snow until self-arrest has been completed; doing so increases the possibility of breaking the ankle or leg or producing a tumbling fall.

b. Head up slope, stomach on the slope and feet pointed down slope:

1. In this position, the body is in proper relation to the slope for an arrest: head up slope, stomach

on the slope, with the feet pointed down slope.

2. If crampons are not worn, the toe of the boots may be dug into the slope to help arrest the fall. If crampons are worn the knees should be bent to keep the crampons off the snow/ice.

3. The axe is held diagonally across the chest, with the head of the axe by one shoulder and the spike near the opposite hip. One hand grasps the head of the axe, with the pick pointed into the slope, while the other hand is on the shaft near the spike.

4. Lift up on the shaft prevent the spike from digging into the slope and to increase the biting action of the pick.

5. Place maximum body weight near the head of the axe by arching the back slightly; this will also increase the biting action of the pick into the snow.

c. Head up slope, back to the slope and feet pointed down slope:

1. In the second position, the body must first be rotated from face up to face down on the slope. This is accomplished by rolling the body toward the head of the axe (see picture below).

2. Once in this position the arrest is completed as described above.

d. Head down slope, stomach on the slope and feet pointed up slope:

1. In the third position, the pick of the ice axe is placed upslope and used as a pivot to bring the body into proper position. Jab the pick in front of you and down slope and rotate around the pick.

2. Once in this position the arrest is completed as described above.

e. Head down slope, back to the slope and feet pointed up slope:

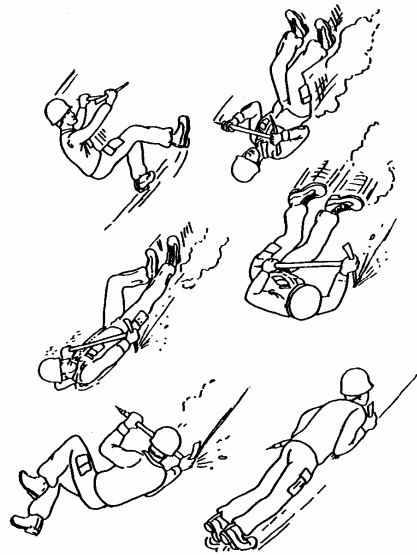
In the fourth position, the head of the axe must be driven into the snow to the climber's side at the hip. Always do this towards the head of the ice axe. This will cause the body to rotate into a head up, stomach down position.



SELF ARREST TECHNIQUE: Head up slope, back to the slope feet pointed down slope

f. Safety considerations for practicing self-arrest:

1. Ensure that the slope you pick to practice on has a safe run-out below it.
 2. Do not wear crampons.
 3. Helmets should be worn.
-



SELF ARREST TECHNIQUE: Head down slope, back to the slope and feet pointed up slope

ELO E

ACTION:	Demonstrate glissading
CONDITION:	In a field environment, given a snow covered slope with a run-out, ice axe and helmet
STANDARD:	Demonstrate glissading IAW the NWTC Mountain Operations Manual.

Learning Step Activity 1 - Glissading

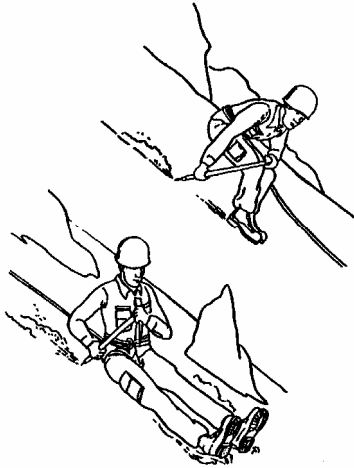
a. Glissading is the intentional, controlled, rapid descent, or slide of a mountaineer down a steep slope covered with snow. Glissading is similar to skiing, except skis are not used. This means that the same balance and control are necessary, but instead of skis the soles of the foot or buttocks are used. The standard ice axe is the only piece of equipment required and acts as the rudder, brake, and guide for the glissade. Never wear crampons while glissading.

b. There are two basic methods of glissading:

1. Squatting Glissade: This is accomplished by placing the body in a semi-crouched position, with both knees bent and the body weight directly over the feet. The ice axe is grasped with one hand on the head, pick, and adze outboard (away from the body), and the other hand on the shaft. The hand on the shaft grips it firmly, in a position that will allow control as well as the application of a downward pressure on the spike of the axe.

2. Sitting Glissade: Using this method the individual sits on the snow with the legs flat, heels and feet raised off the slope and pointed down slope. The ice axe is firmly grasped in the same manner as the squatting glissade, with the exception that the hand on the shaft must be locked against the hip for control. The sitting glissade is slower but easier to control than the squatting glissade.

Safety. A glissade should never be attempted on a slope where the bottom cannot be seen, since drop-offs may exist out of view. Also, a sitting glissade should not be used if the snow cover is very thin, as painful injury could result.



Squatting and sitting glissades

ELO F

ACTION:	Demonstrate step cutting on snow and ice
CONDITION:	Outside and on a snow and ice covered slope
STANDARD:	Properly show how to step cut in snow and ice

Learning Step Activity 1 - Step Cutting

a. Step cutting is an extremely valuable technique that is a required skill for any military mountaineer. The use of cut steps can save valuable time that would be spent in donning crampons for short stretches of ice and can, in some cases, save the weight of the crampons altogether. Steps may also have to be cut by the lead team to enable a unit without proper equipment to negotiate snow or ice covered terrain.

Techniques:

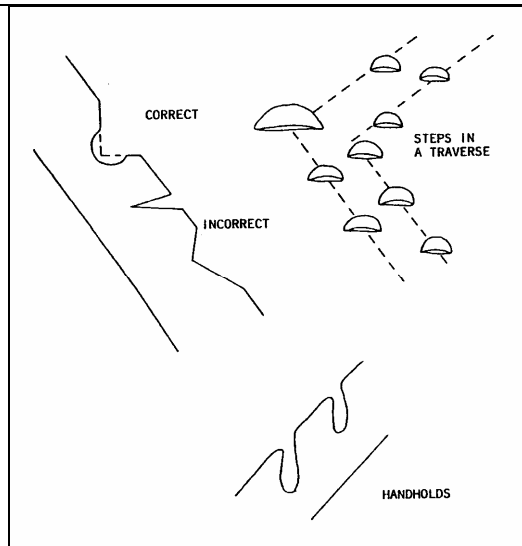
1. Snow: On slopes of firm snow and soft ice steps may be cut by swinging the axe in a near-vertical plane, using the inside corner of the adze for cutting. The step should be fashioned so that it slopes slightly inward and is big enough to admit the entire foot. Steps used for resting or for turning must be larger.

2. Ice: Hard ice requires that the pick of the axe be used. Begin by directing a line of blows at right angles to the slope to make a fracture line along the base of the intended step. This technique will reduce the chance of an unwanted fracture of the ice breaking out the entire step. Next, chop above the fracture line to fashion out the step. When using the pick it should be given an outward jerk as it is placed to prevent it from sticking in the ice.

b. As units continue to move up areas where steps have been cut they should continue to improve each step. In ascending, steps may be cut straight up the slope, although a traverse will normally be adopted. In descending, a traverse is also the preferred method. When changing direction, a step large enough for both feet and crampons must be made. Once the step is formed, the adze is best used to further shape and clean the step.

Step Cutting in a Traverse: When cutting steps in a traverse, the preferred cutting sequence is to cut one step at an arm's length from the highest step already cut, then cut one between those two. Cutting ahead one step then cutting an intermediate step keeps all of the steps relatively close to one another and maintains a suitable interval that all personnel can use.

Handholds: If handholds are cut, they should be smaller than footholds, and angled more.



SECTION IV**SUMMARY**

Check on Learning

1. Explain the difference between French and German technique of using crampons?
French technique is flat footing. German technique uses the front points of the crampons.

2. Describe the proper position of the ice axe when performing the self arrest.

The axe is held diagonally across the chest, with the head of the axe by one shoulder and the spike near the opposite hip. One hand grasps the head of the axe, with the pick pointed into the slope, while the other hand is on the shaft near the spike.

Review and Summarize Lesson

ACTION:	Demonstrate the ability to move in a snow and/or ice covered environment
CONDITION:	In a snow and/or ice covered environment, given an ice axe, crampons
STANDARD:	Demonstrate the ability to move in a snow and/or ice covered environment IAW the NWTC Mountain Operations Manual.

Transition to next lesson

As per the NWTC training schedule; dependent upon the course in conduct

SECTION V**STUDENT EVALUATION**

**Testing
Requirements**

Students will be tested on this task during the Alpine FTX and questions related to the subject matter may appear on the written test.

**Feedback
Requirement**

Students will receive two opportunities to pass each event tested. Re-training will be conducted for students that fail the first iteration of testing. Refer to M020 for specifics.
